

PCT

NOTIFICATION OF ELECTION

(PCT Rule 61.2)

From the INTERNATIONAL BUREAU

To:

Assistant Commissioner for Patents
 United States Patent and Trademark
 Office
 Box PCT
 Washington, D.C.20231
 ÉTATS-UNIS D'AMÉRIQUE

in its capacity as elected Office

Date of mailing (day/month/year) 15 February 2000 (15.02.00)	
International application No. PCT/CA99/00428	Applicant's or agent's file reference F141 0010
International filing date (day/month/year) 21 May 1999 (21.05.99)	Priority date (day/month/year) 26 May 1998 (26.05.98)
Applicant McALISTER, Steven, A. et al	

1. The designated Office is hereby notified of its election made:

☒ in the demand filed with the International Preliminary Examining Authority on:
 14 December 1999 (14.12.99)

☐ in a notice effecting later election filed with the International Bureau on:

2. The election ☒ was
☐ was not

made before the expiration of 19 months from the priority date or, where Rule 32 applies, within the time limit under Rule 32.2(b).

The International Bureau of WIPO 34, chemin des Colombettes 1211 Geneva 20, Switzerland	Authorized officer Jean-Marc Vivet
Facsimile No.: (41-22) 740.14.35	Telephone No.: (41-22) 338.83.38

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PATENT COOPERATION TREATY

PCT

INTERNATIONAL PRELIMINARY EXAMINATION REPORT

(PCT Article 36 and Rule 70)



Applicant's or agent's file reference F141 0010	FOR FURTHER ACTION See Notification of Transmittal of International Preliminary Examination Report (Form PCT/IPEA/416)	
International application No. PCT/CA99/00428	International filing date (day/month/year) 21/05/1999	Priority date (day/month/year) 26/05/1998
International Patent Classification (IPC) or national classification and IPC B04B1/00		
Applicant FALCON CONCENTRATORS INC. et al.		

1. This international preliminary examination report has been prepared by this International Preliminary Examining Authority and is transmitted to the applicant according to Article 36.
2. This REPORT consists of a total of 6 sheets, including this cover sheet.
 - ☒ This report is also accompanied by ANNEXES, i.e. sheets of the description, claims and/or drawings which have been amended and are the basis for this report and/or sheets containing rectifications made before this Authority (see Rule 70.16 and Section 607 of the Administrative Instructions under the PCT).

These annexes consist of a total of 7 sheets.

3. This report contains indications relating to the following items:

- I ☒ Basis of the report
- II ☐ Priority
- III ☐ Non-establishment of opinion with regard to novelty, inventive step and industrial applicability
- IV ☐ Lack of unity of invention
- V ☒ Reasoned statement under Article 35(2) with regard to novelty, inventive step or industrial applicability; citations and explanations supporting such statement
- VI ☐ Certain documents cited
- VII ☒ Certain defects in the international application
- VIII ☐ Certain observations on the international application

Date of submission of the demand 14/12/1999	Date of completion of this report 11.08.00
Name and mailing address of the international preliminary examining authority:  European Patent Office D-80298 Munich Tel. +49 89 2399 - 0 Tx: 523656 epmu d Fax: +49 89 2399 - 4465	Authorized officer Maier, M Telephone No. +49 89 2399 2477 

**INTERNATIONAL PRELIMINARY
EXAMINATION REPORT**

International application No. PCT/CA99/00428

I. Basis of the report

1. This report has been drawn on the basis of (*substitute sheets which have been furnished to the receiving Office in response to an invitation under Article 14 are referred to in this report as "originally filed" and are not annexed to the report since they do not contain amendments.*):

Description, pages:

1-4,7,8	as originally filed		
5,6,9,10	as received on	28/07/2000	with letter of 20/07/2000

Claims, No.:

10-13	as originally filed		
1-9	as received on	28/07/2000	with letter of 20/07/2000

Drawings, sheets:

1/8-8/8	as originally filed
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2. The amendments have resulted in the cancellation of:

- ☐ the description, pages:
- ☐ the claims, Nos.:
- ☐ the drawings, sheets:

3. ☐ This report has been established as if (some of) the amendments had not been made, since they have been considered to go beyond the disclosure as filed (Rule 70.2(c)):

4. Additional observations, if necessary:

**INTERNATIONAL PRELIMINARY
EXAMINATION REPORT**

International application No. PCT/CA99/00428

V. Reasoned statement under Article 35(2) with regard to novelty, inventive step or industrial applicability; citations and explanations supporting such statement

1. Statement

Novelty (N)	Yes:	Claims	1-9
	No:	Claims	
Inventive step (IS)	Yes:	Claims	8
	No:	Claims	1-7, 9
Industrial applicability (IA)	Yes:	Claims	1-9
	No:	Claims	

2. Citations and explanations

see separate sheet

VII. Certain defects in the international application

The following defects in the form or contents of the international application have been noted:

see separate sheet

Re Item V

Reasoned statement under Rule 66.2(a)(ii) with regard to novelty, inventive step or industrial applicability; citations and explanations supporting such statement

1. Reference is made to the following documents:

D1: US-A-5 462 513

D3: US-A-3 090 591

2. Document D1, which is considered to represent the most relevant state of the art, discloses (cf. column 2, lines 18-31, claim 1 and Fig. 2) a centrifugal concentrator for separating particulate material of higher specific gravity from particulate material of lower specific gravity from which the subject-matter of claim 1 differs in that the passage (110) of the flow controlling means is radially constrictible from a fully open to a closed condition while maintaining a cross-sectional shape which is substantially circular over a major range of such radial constriction.

The subject-matter of claim 1 is therefore novel (Article 33(2) PCT).

The problem to be solved by the present invention may therefore be regarded as providing a flow controlling means for a centrifugal concentrator, said flow controlling means having a fluid passage with adjustable cross-section and combining the advantages of allowing the passage of particles as coarse as possible while minimizing the amount of water flowing out the centrifugal concentrator.

The solution proposed in claim 1 of the present application cannot be considered as involving an inventive step (Article 33(3) PCT) for the following reasons.

The document D3 discloses (column 3, line 20 to column 6, line 69, Figs. 1-6) a flow control valve according to the characterizing portion of claim 1. D3 explicitly teaches the advantage of this kind of valve (column 1, lines 22-45), used in pipelines carrying solids suspended in liquid, as providing a substantially circular port the diameter of which may be selectively varied. The skilled person would therefore regard it as a normal option to include this feature in the continuous

discharge centrifuge described in document D1 in order to improve the valves. Hence the subject-matter of claim 1 does not involve an inventive step (Article 33(3) PCT).

3. The additional features of dependent claims 2 - 7 and 9 apparently relate to design features which are known as advantageous from the state of the art (D3), therefore a person skilled in the art would find it obvious or inevitable to incorporate them in the centrifugal concentrator achieved by combining the documents D1 and D3.

The additional features of claim 2 are known from column 3, line 20 - 33, column 5, line 20 - 44, and Fig. 1, 3 and 4 of D3.

The additional feature of claim 3 is disclosed in column 1, line 14 - 19, of D3.

The additional feature of claim 4 is disclosed in column 6, line 3 - 16, and Fig. 1 and 3 of D3.

The additional features of claims 5 and 6 are disclosed in column 5, line 31 - 44, and also column 2, line 3 - 6, of D3.

The additional feature of claim 7 is disclosed in column 4, line 8 - line 26 and Fig. 1 of D3.

The additional feature of claim 9 is disclosed in column 4, line 3 - line 7 of D3.

Therefore claims 2-7 and 9 do not involve an inventive step (Article 33(3) PCT).

4. The additional features of claim 8 solve the problem to improve the function of the valve member by preventing transitory air leakage from the chamber of the valve body around the ends of the constrictor element.

This solution is neither known from, nor rendered obvious by the prior art documents.

Therefore the subject-matter of claim 8 is considered to involve an inventive step and claim 8 meets the requirements of Art. 33 (3) PCT.

5. The invention as specified in the claims is industrially applicable in the production of centrifugal concentrators for separating particulate material of higher specific gravity from particulate material of lower specific gravity.

Re Item VII

Certain defects in the international application

1. Although claim 1 is drafted in the two-part form the features "flow controlling means (37) comprising a fluid inlet communicating with said outwardly-extending outlet, a fluid outlet and a passage (communicating therebetween and having a cross-sectional radius in the plane perpendicular to the longitudinal axis of said passage" are incorrectly placed in the characterising portion, as they are disclosed in document D1 (column 3, line 15 - 44, column 5, line 49 - column 6, line 8, Fig. 2 and 12-19) in combination with the features placed in the preamble (Rule 6.3(b) PCT).
2. The units of measure employed on pages 6 and 7 ("hardness 75D"), and in Fig. 12 (inch, ") are not additionally expressed in terms of the units stipulated by Rule 10.1/(a)/and/(b) PCT. Furthermore, an error has occurred during amendment of page 10, because 3/8 inches equal to 0.9525 cm, not to 9525 cm (line 1).
3. According to the requirements of Rule 11.13(m) PCT the same feature shall be denoted by the same reference sign throughout the application. This requirement is not met in view of various features, the following list of examples not being exhaustive:

37 for flow controlling means (claim 1) and for flow control valves (page 5, line 23 ff.),

18 in for material supply means (claim 1) and for slurry feed pipe (page 5, line 12 ff.),

110 for passage (claim 1) and bore (page 8, line 27 ff.),

102 for valve member (claim 2) and sleeve (page 7, line 13),

104 for constrictor element (claim 2) and valve muscle (page 7, line 21 ff.), etc.

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in Fig. 10 taken along lines D-D; and

Fig. 12 is a chart comparing the size of particle which can pass through the valve of the present invention at a given flow constriction, to that of a conventional pinch valve.

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DETAILED DESCRIPTION OF A PREFERRED EMBODIMENT

With reference to Figures 1 and 2, the inventor's centrifuge as shown in U.S. Patent no. 5,462,513, and incorporating the present invention is designated by reference numeral 1. It has a frame 3, a shroud 4 consisting of shroud lid 5 and tailings launder 14, and drive motor 9. The frame is constructed of hollow steel sections. The shroud lid 5 has openings for a slurry feed pipe 18 and inspection ports 17 and an inner lining 32 of a wear resistant material such as LINATEX™. The flange of shroud lid 5 is bolted to an upper flange of tailings launder 14. Tailings launder 14 is provided with a tailings discharge port 19. Nested in tailings launder 14 is a concentrate launder 16 with a concentrate discharge port 20. The floors 22 and 24 respectively of launders 14 and 16 form helical spirals downwardly to assist in a smooth outward flow of the discharge and are preferably coated with an ultra-high molecular weight polyethylene. Water may be introduced at ports 26 to further assist the flow in the launder. The upper section of the tailings launder, where it forms the outer wall of the concentrate launder adjacent the output of flow control valves 37, is also provided with an inner lining 32 of a wear resistant material such as LINATEX™. The upper outside edge 7 of concentrate launder 16 extends into a circular slot 11 formed on the inner wall of tailings launder 14, forming a labyrinth barrier between the two launders.

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Rotor 21 has an inner surface of rotor bowl 23 forming three zones: a migration zone, a retention zone and a lip zone, zones A, B and C respectively as described in U.S. Patent no. 4,824,431, which cause the denser, target particles from the slurry flow to be concentrated in the retention zone. The rotor 21 is mounted in the frame 3 by bearing assemblies 25. The rotor has a sheave 27 which is driven by a belt (not shown) driven by electric motor 9. The rotor is provided with hopper rings 35 and flow control valves 37, which will be described in further detail below. An impeller 28 is provided on the centre of the floor of bowl 23 which has three or four upstanding vanes to assist in the rotation of the slurry. A continuous 1/2 - inch slot 55 formed in the surface of the retention zone B between the lower edge of the inner surface of lip 31 and the upper edge of the inner surface of lower bowl 30. Slot 55 opens to a series of mass-flow hoppers formed between two polyurethane hopper rings which hoppers in turn open to the flow control valves 37.

Rotor bowl 23 is formed of a steel lower bowl section 30, and steel lip 31. The inner surface of the rotor bowl has a lining 32 of a wear resistant material such as a 1/4-inch (.635 cm.) layer of LINATEX™. Air supply pipe 36 runs up the centre of rotor shaft 34 and connects the rotating union adapter 39 to flow control valves 37. Union adapter 39 connects the rotor shaft to rotating union 50. A cover 51 is provided to shield the union 50 and adapter 39.

The flow control valves 37 are operated by compressed air which is supplied to the rotor by rotating union 50. The purpose of the rotating union is to provide the compressed air from a storage tank 52 (to which pressurized air is periodically supplied through 53) via two sta-

End plate 106 is secured to the valve body 100 through threaded holes 121 using screws 111 or the like. O-ring 107 is provided in annular depression 129 to seal the end plate 106 to the valve body 100. Bushing 108, of tungsten carbide or like material, around bore 110
5 resists abrasion from the flow of concentrate and may be rotated periodically to increase its part life. To secure the valve body 100 to the machine, bolt 113 is provided through hole 124. Two further bolts 125 are provided through slots 126. In this way the valve can be fully removed by removing bolt 113 and simply loosening the two remaining
10 bolts 125.

In operation, air pressure is typically first applied to the flow control valves 37 to close them. Motor 9 is activated to rotate the rotor. The slurry feed is introduced to the spinning rotor through feed pipe 18. Centrifugal forces cause the slurry to climb up the inner surface of the
15 rotor bowl past slot 55 before being expelled past lip 31, into tailings launder 14 and thence out of the machine through discharge port 19. The hoppers are initially empty prior to introduction of the slurry. They rapidly fill with solids as the slurry is introduced. The hopper outlets remain closed during the initial stage. As the process advances, heavier
20 concentrate accumulates in the retention zone. This accumulation of concentrate fills the hoppers. The controlled opening of the flow control valves 37 now operates to remove some of the material from the hopper. Such material is expelled by centrifugal force through valve bore 110 into concentrate launder 16. The diameter of orifice 110 may be varied
25 automatically by a process controller or manually. To prevent clogging, it can be programmed to automatically and periodically "burp" open from a constricted diameter of, for example 1/8 inches (.3175 cm.) to an open

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diameter of 3/8 inches (9525 cm.) every few minutes. The preferred fully open diameter of sleeve 102 is 1/2 inch (1.27 cm.). Similarly, in a Kelsey jig for example, a vibration monitor could detect an imbalance condition indicating a blocked spigot which would then automatically
5 enlarge the valve orifice.

Fig. 12 is a chart comparing the size of particle which can pass through the valve of the present invention at a given flow constriction, to that of a conventional pinch valve. The vertical axis plots the maximum diameter of sphere which can pass through the orifice which
10 is 1/2 (1.27 cm.) inch at its maximum opening. The horizontal axis plots the percentage of the maximum cross-sectional area to which the orifice is constricted. The solid line illustrates the performance of the concentric closure of the invention, while the dotted line plots the conventional pinch valve, which is subject to frequent blockages when the maximum particle
15 passage size hits .150 inches (.381 cm.). The chart thus illustrates that the concentric closure of the present invention permits a greater percentage closure of the flow before reaching the limit of frequent blockage. This results from the fact that in the pinch valve, the perimeter of the orifice remains constant while its shape changes to
20 reduce the cross-sectional area, while in the present invention the perimeter of the orifice decreases as the cross-sectional area decreases.

As will be apparent to those skilled in the art, various modifications and adaptations of the structure above described may be made without departing from the spirit of the invention, the scope of
25 which is to be construed in accordance with the accompanying claims.

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I CLAIM:

1. A centrifugal concentrator for separating particulate material of higher specific gravity from particulate material of lower specific gravity, comprising a) a rotating member (21) adapted for rotation about an axis, (b) material supply means (18) to deliver said particulate material into said rotating member, c) a plurality of cavities for receiving said particulate material of higher specific gravity, extending radially outwardly with respect to the axis of rotation of said rotating member, said cavities each having an outwardly-extending outlet, and d) flow controlling means (37) for controlling the flow of material from said outwardly-extending outlets of said cavities; characterized in that said flow controlling means (37) comprises a fluid inlet communicating with said outwardly-extending outlet, a fluid outlet and a passage (110) communicating therebetween and having a cross-sectional radius in the plane perpendicular to the longitudinal axis of said passage (110), wherein said passage (110) is radially constrictible from a fully open to a closed condition while maintaining a cross-sectional shape which is substantially circular over a major range of such radial constriction.
2. The centrifugal concentrator of claim 1 wherein said flow controlling means (37) comprises a cylindrical elastomeric valve member (102) disposed within said passage, and an annular elastomeric constrictor element (104) mounted coaxially around said cylindrical elastomeric valve member (102) and having a central thickened region for contacting and constricting said cylindrical elastomeric valve member (102).

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3. The centrifugal concentrator of claim 1 wherein said radially constrictible passage (110) of said flow controlling means (37) has a cross-sectional shape which is substantially circular over at least half said range of radial constriction of said passage (110).
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4. The centrifugal concentrator of claim 1 wherein said radially constrictible passage (110) of said flow controlling means (37) has a maximum dimension in the plane perpendicular to the longitudinal axis of said passage (110) which remains comparable to the dimension of said
- 10 passage (110) perpendicular to said maximum dimension over a substantial range of radial constriction of said passage (110).
5. The centrifugal concentrator of claim 3 wherein said radially constrictible passage (110) of said flow controlling means (37) has a
- 15 maximum diameter of at least one-half inch (1.27 cm.).
6. The centrifugal concentrator of claim 3 wherein said range of radial constriction of said passage (110) is from at least as small as 1/8 inch (.3175 cm.) to at least as great as 1/2 inch (1.27 cm.).
- 20
7. The centrifugal concentrator of claim 2 wherein flow controlling means (37) comprise a valve body (100), and said valve body comprises an air passageway (114) communicating with a compressed air supply for supplying air under pressure to the exterior of said annular elastomeric
- 25 constrictor element (104).
8. The centrifugal concentrator of claim 2 wherein said flow

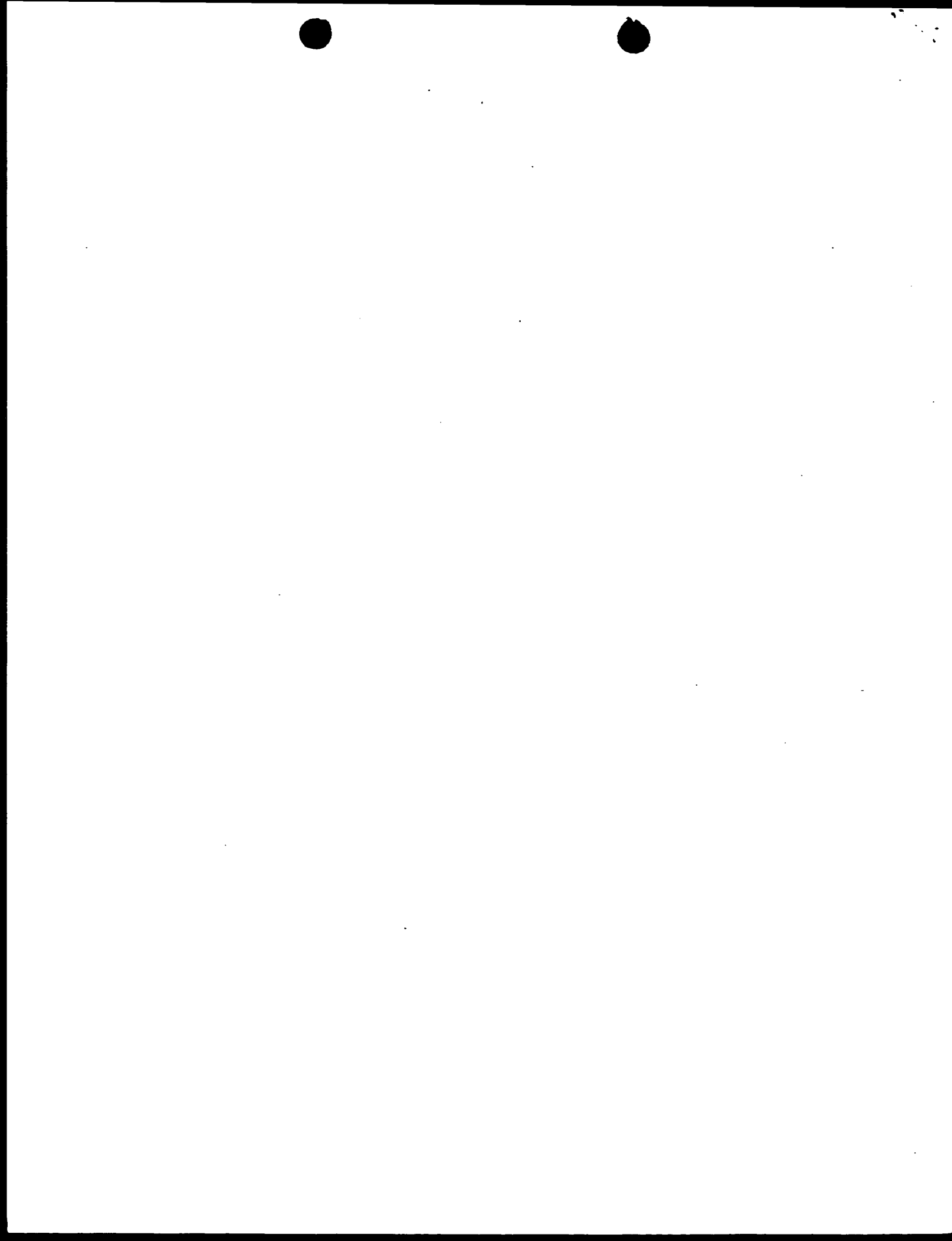
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controlling means (37) comprise a valve body (100), and a pressure relief passage (130) extending from the outer surface of said cylindrical elastomeric valve member (102) to the exterior of the valve body (100).

- 5 9. The centrifugal concentrator of claim 2 wherein said flow controlling means (37) comprise a valve body (100) and said annular elastomeric constrictor element (104) is held in a chamber (116) in said valve body (100) and is pre-compressed to fit said chamber (116).

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INTERNATIONAL SEARCH REPORT

(PCT Article 18 and Rules 43 and 44)

Applicant's or agent's file reference F141 0010	FOR FURTHER ACTION see Notification of Transmittal of International Search Report (Form PCT/ISA/220) as well as, where applicable, item 5 below.	
International application No. PCT/CA 99/ 00428	International filing date (day/month/year) 21/05/1999	(Earliest) Priority Date (day/month/year) 26/05/1998
Applicant FALCON CONCENTRATORS INC. et al.		

This International Search Report has been prepared by this International Searching Authority and is transmitted to the applicant according to Article 18. A copy is being transmitted to the International Bureau.

This International Search Report consists of a total of 2 sheets.



It is also accompanied by a copy of each prior art document cited in this report.

1. Basis of the report

- a. With regard to the **language**, the international search was carried out on the basis of the international application in the language in which it was filed, unless otherwise indicated under this item.



the international search was carried out on the basis of a translation of the international application furnished to this Authority (Rule 23.1(b)).

- b. With regard to any **nucleotide and/or amino acid sequence** disclosed in the international application, the international search was carried out on the basis of the sequence listing :



contained in the international application in written form.



filed together with the international application in computer readable form.



furnished subsequently to this Authority in written form.



furnished subsequently to this Authority in computer readable form.



the statement that the subsequently furnished written sequence listing does not go beyond the disclosure in the international application as filed has been furnished.



the statement that the information recorded in computer readable form is identical to the written sequence listing has been furnished

2. ☐ **Certain claims were found unsearchable** (See Box I).

3. ☐ **Unity of invention is lacking** (see Box II).

4. With regard to the **title**,



the text is approved as submitted by the applicant.



the text has been established by this Authority to read as follows:

5. With regard to the **abstract**,



the text is approved as submitted by the applicant.



the text has been established, according to Rule 38.2(b), by this Authority as it appears in Box III. The applicant may, within one month from the date of mailing of this international search report, submit comments to this Authority.

6. The figure of the **drawings** to be published with the abstract is Figure No.



as suggested by the applicant.



because the applicant failed to suggest a figure.



because this figure better characterizes the invention.

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None of the figures.



A. CLASSIFICATION OF SUBJECT MATTER IPC 6 B04B1/00 B04B1/10 B04B11/02		
According to International Patent Classification (IPC) or to both national classification and IPC		
B. FIELDS SEARCHED Minimum documentation searched (classification system followed by classification symbols) IPC 6 B04B B03B		
Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched		
Electronic data base consulted during the international search (name of data base and, where practical, search terms used)		
C. DOCUMENTS CONSIDERED TO BE RELEVANT		
Category *	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
Y	°US 5 462 513 A (S.A. MCALISTER) 31 October 1995 (1995-10-31) cited in the application the whole document ---	1-13
Y	GB 973 457 A (SHARPLES CORP.) 28 October 1964 (1964-10-28) page 4, line 1 - line 105 figure 3 ---	1-13
A	~ US 3 090 591 A (J.R. CLARKSON) 21 May 1963 (1963-05-21) cited in the application the whole document -----	
<input type="checkbox"/> Further documents are listed in the continuation of box C. <input checked="" type="checkbox"/> Patent family members are listed in annex.		
° Special categories of cited documents : "A" document defining the general state of the art which is not considered to be of particular relevance "E" earlier document but published on or after the international filing date "L" document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified) "O" document referring to an oral disclosure, use, exhibition or other means "P" document published prior to the international filing date but later than the priority date claimed "T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention "X" document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone "Y" document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art. "&" document member of the same patent family		
Date of the actual completion of the international search		Date of mailing of the international search report
17 September 1999		24/09/1999
Name and mailing address of the ISA European Patent Office, P.B. 5818 Patentlaan 2 NL - 2280 HV Rijswijk Tel. (+31-70) 340-2040, Tx. 31 651 epo nl, Fax: (+31-70) 340-3016		Authorized officer Leitner, J



INTERNATIONAL SEARCH REPORT

Information on patent family members

International Application No

PCT/CA 99/00428

Patent document cited in search report	Publication date	Patent family member(s)	Publication date
US 5462513 A	31-10-1995	CA 2059208 A	14-07-1993
		AU 3340593 A	03-08-1993
		WO 9313864 A	22-07-1993
		EP 0620764 A	26-10-1994
		SG 44773 A	19-12-1997
<hr/>			
GB 973457 A		NONE	
<hr/>			
US 3090591 A	21-05-1963	NONE	
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INTERNATIONAL APPLICATION PUBLISHED UNDER THE PATENT COOPERATION TREATY (PCT)

(51) International Patent Classification⁶:

B04B 1/00, 1/10, 11/02

A1

(11) International Publication Number:

WO 99/61161

(43) International Publication Date:

2 December 1999 (02.12.99)

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(30) Priority Data:

2,238,897

26 May 1998 (26.05.98)

CA

(71) Applicant (for all designated States except US): FALCON CONCENTRATORS INC. [CA/CA]; 9663 - 199A Street, Langley, British Columbia V1M 2X7 (CA).

(72) Inventors; and

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(74) Agent: GREEN, Bruce, M.; Oyen Wiggs Green & Mutala, 601 West Cordova Street #480, Vancouver, British Columbia V6B 1G1 (CA).

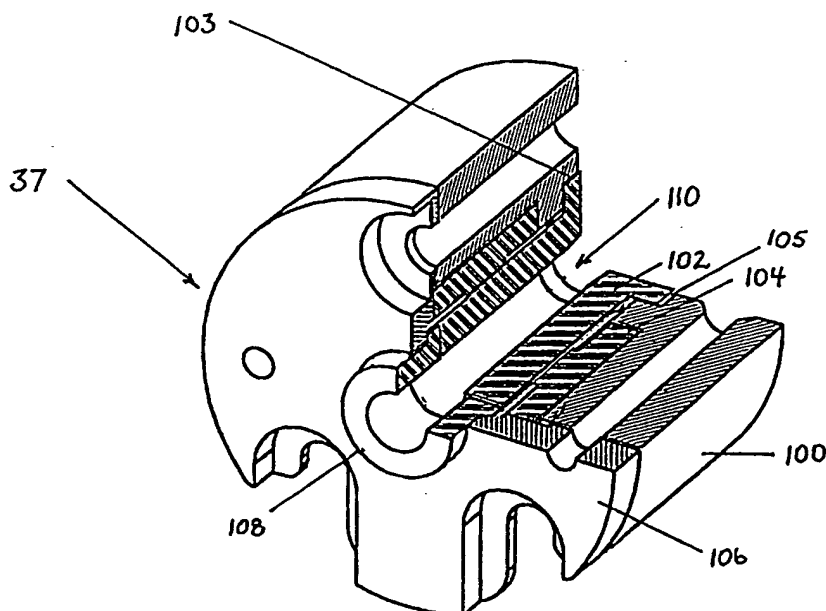
(81) Designated States: AE, AL, AM, AT, AT (Utility model), AU, AZ, BA, BB, BG, BR, BY, CA, CH, CN, CU, CZ, CZ (Utility model), DE, DE (Utility model), DK, DK (Utility model), EE, ES, FI, GB, GD, GE, GH, GM, HR, HU, ID, IL, IN, IS, JP, KE, KG, KP, KR, KZ, LC, LK, LR, LS, LT, LU, LV, MD, MG, MK, MN, MW, MX, NO, NZ, PL, PT, RO, RU, SD, SE, SG, SI, SK, SK (Utility model), SL, TJ, TM, TR, TT, UA, UG, US, UZ, VN, YU, ZA, ZW, ARIPO patent (GH, GM, KE, LS, MW, SD, SL, SZ, UG, ZW), Eurasian patent (AM, AZ, BY, KG, KZ, MD, RU, TJ, TM), European patent (AT, BE, CH, CY, DE, DK, ES, FI, FR, GB, GR, IE, IT, LU, MC, NL, PT, SE), OAPI patent (BF, BJ, CF, CG, CI, CM, GA, GN, GW, ML, MR, NE, SN, TD, TG).

Published

With international search report.

Before the expiration of the time limit for amending the claims and to be republished in the event of the receipt of amendments.

(54) Title: FLOW CONTROL VALVE FOR CONTINUOUS DISCHARGE CENTRIFUGAL CONCENTRATORS



(57) Abstract

Prior continuous discharge centrifugal concentrators for separating higher density particles from a slurry have used pinch valves to control the flow of discharge. Such pinch valves tend to be blocked by coarse particles, requiring shutdown of the machine. The present invention provides a muscle-type valve to provide a circular orifice for the valve bore of continuously variable perimeter.

FOR THE PURPOSES OF INFORMATION ONLY

Codes used to identify States party to the PCT on the front pages of pamphlets publishing international applications under the PCT.

AL	Albania	ES	Spain	LS	Lesotho	SI	Slovenia
AM	Armenia	FI	Finland	LT	Lithuania	SK	Slovakia
AT	Austria	FR	France	LU	Luxembourg	SN	Senegal
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BE	Belgium	GN	Guinea	MK	The former Yugoslav Republic of Macedonia	TM	Turkmenistan
BF	Burkina Faso	GR	Greece	ML	Mali	TR	Turkey
BG	Bulgaria	HU	Hungary	MN	Mongolia	TT	Trinidad and Tobago
BJ	Benin	IE	Ireland	MR	Mauritania	UA	Ukraine
BR	Brazil	IL	Israel	MW	Malawi	UG	Uganda
BY	Belarus	IS	Iceland	MX	Mexico	US	United States of America
CA	Canada	IT	Italy	NE	Niger	UZ	Uzbekistan
CF	Central African Republic	JP	Japan	NL	Netherlands	VN	Viet Nam
CG	Congo	KE	Kenya	NO	Norway	YU	Yugoslavia
CH	Switzerland	KG	Kyrgyzstan	NZ	New Zealand	ZW	Zimbabwe
CI	Côte d'Ivoire	KP	Democratic People's Republic of Korea	PL	Poland		
CM	Cameroon	KR	Republic of Korea	PT	Portugal		
CN	China	KZ	Kazakstan	RO	Romania		
CU	Cuba	LC	Saint Lucia	RU	Russian Federation		
CZ	Czech Republic	LI	Liechtenstein	SD	Sudan		
DE	Germany	LK	Sri Lanka	SE	Sweden		
DK	Denmark	LR	Liberia	SG	Singapore		
EE	Estonia						